Conformable Thermoelectric Device for Waste Heat Scavenging in Space Applications, Phase I

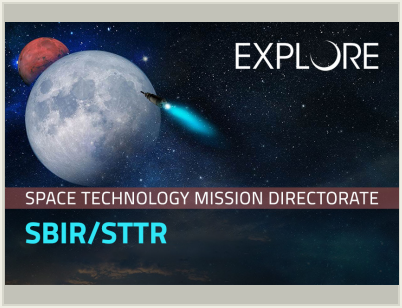
Completed Technology Project (2009 - 2010)

Project Introduction

NASA space exploration missions stand to benefit from reliable means to conserve energy that is otherwise given off as waste heat. Thermoelectric generators have demonstrated the potential for scavenging waste heat energy, yet are still limited by technical and geometrical boundaries that must be overcome for long term reliability in applications such as interplanetary missions. To address these limitations, Nanohmics Inc. and Professor Kevin Stokes at the University of New Orleans propose to fabricate conformable thermoelectric generators for long-term radiation resistance in space applications. The proposed device will incorporate thermoelectric p- and n-doped high ZT thermoelectric legs that aredeposited onto a substrate.

Anticipated Benefits

Thermoelectric devices have the ability to enable/accelerate a wide variety of applications. Major applications of thermoelectric devices include: Cooling of electronics (integrated circuits, detectors/focal plane arrays, microprocessors, disk drives, solid state lasers) Power generation from waste heat or engine exhaust (thermoelectric generator mode) Power generation in remote areas using temporal fluctuations with daily cycles Satellite power recovery Cooling of heavy equipment and machining processes Distributed cooling systems for confined spaces (automobiles, military vehicles, submarines) Man portable or embedded cooling systems for soldier battle dress uniforms (BDUs) or other wearable devices that can extract energy from body heat Precision temperature control Lightweight thermoelectric generators that have the ability to conform to custom geometries offer many advantages in waste heat recovery over traditional rigid plate TEG devices. The proposed device will possess inherent radiation hardness as well as have low stowed weight making it ideal for thermoelectric-driven waste heat energy scavenging on interplantary and other space missions.



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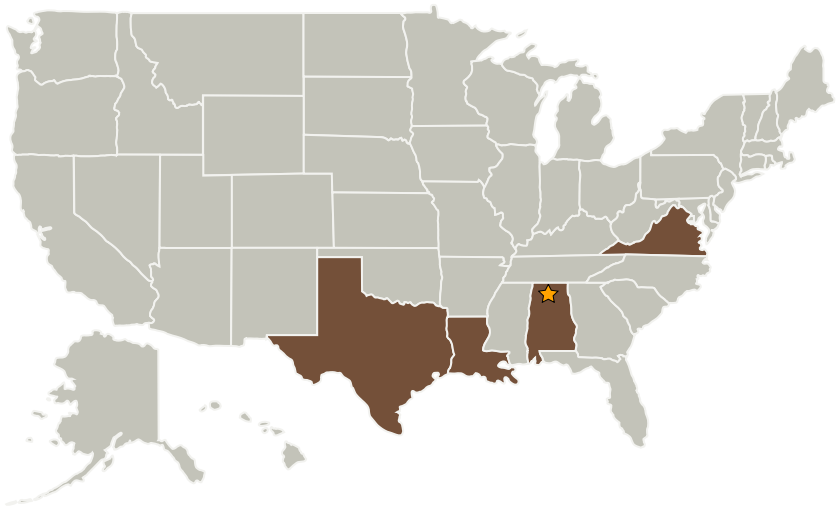
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Nanohmics, Inc.	Supporting Organization	Industry	Austin, Texas
University of New Orleans	Supporting Organization	Academia	New Orleans, Louisiana

Primary U.S. Work Locations	
Alabama	Louisiana
Texas	Virginia

Project Transitions

January 2009: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Narasimha S Prasad

Principal Investigators:

James P Patterson
Steve Savoy

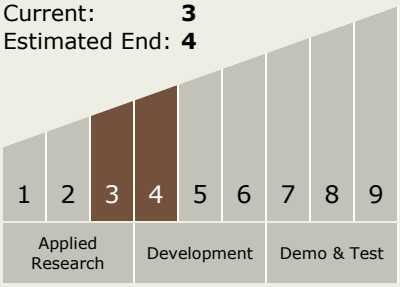
Conformable Thermoelectric Device for Waste Heat Scavenging in Space Applications, Phase I

Completed Technology Project (2009 - 2010)

January 2010: Closed out

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.3 Static Energy Conversion